

DOWNRANGE POWER & DATA DISTRIBUTION - 300 METERS AND UNDER

Function: The section will explain in general terms, the basic design requirements for downrange power and data distribution to control Next Generation Army Target System (NGATS) range targetry and its associated equipment.

General Summary: For ranges 300m deep and under, each lane will be powered individually from the ROC-Tower Power Distribution Panel usually located underneath the tower, but may be located up to a minimum of 5m behind the firing lane. Lanes and targets on ranges greater than 300m deep will be powered from downrange power centers (PC) located on the range. All targetry will be controlled over Ethernet based networks. These networks will be comprised of a combination of fiber optics and copper based systems maximizing the use of Commercial Off The Shelf (COTS) and standards. See Electrical Details in the Appendix of this document.

Targetry Power Requirements:

EMPLACEMENT TYPE	POWER FEED TYPE	PEAK	STATIC LOAD	DESIGN LOAD
SIT	120/240V, Single Phase	700VA while raising or lowering target & firing Infantry Hostile Fire Simulator(IHFS)	50VA	700VA
Thermal Target	120V	260VA	260VA	260VA
SAT	120/240V Single Phase	2kW	100VA	1.8kW
Thermal Target	120V	1kVA	1kVA	1kVA
MIT	120/240V Single Phase	2kVA during system charging	50VA	2kVA
MAT	120/240V Single Phase	3.8kVA during system charging	100VA	3.8kVA
Range Control System (RCS)*	120V Single Phase	Associated Control Equipment		5.37kVA (ROC- Tower only)
* STRICOM supplied equipment, coordinate during design.				

TARGETRY POWER TABLE

Targetry Data Requirements.

RANGE TYPE	MEDIUM	SPEED	BANDWIDTH	WAVELENGTH/ FREQUENCY
Ranges 300 meters & under	Multimode Fiber Optic Cable, 62.5 micron	Minimum 10Mbps	Min 200Mhz-km	850nm
			Min 500Mhz-km	1300nm
	CAT5E or better Cable	Minimum 10Mbps	200Mhz	200Mhz

TARGETRY DATA TABLE

	ROC Tower kVA	ROC Small kVA	ROC Large kVA	Ops\Storage kVA	Gen. Instruction kVA	Latrine kVA	Bleacher Enc. kVA	Covered Mess kVA	Ammo Break. kVA	SIT kVA	SAT kVA	MIT kVA	MAT kVA	VPS/BES/MSD kVA	Floodlights kVA (White & Red)	Training Buildings kVA	TOTAL CONNECTED (kVA)	TOTAL DEMAND (kVA)
	13	75	113	8.2	6.3	4.4	1.7	3.4	2.2	50%	50%	50%	75%	75%	100%	50%		
	11	50	80	7.1	5.2	3.1	1.7	3.4	2.2	1.0	2.8	2.0	3.9	0.5	3.3	20.0		
25m Zero	X			X	X	X	X	X	X								39	34
AFF	X			X	X	X	X	X	X	96					16		188	135
ARF	X			X	X	X	X	X	X	112					8		178	116
MRF	X			X	X	X	X	X	X	144					8		210	132
QTR	X			X	X	X	X	X	X	339	20	20			8		501	278
Sniper F Fire	X			X	X	X	X	X	X	40		8			2		102	68
CP/MPQC	X			X	X	X	X	X	X	105					4		157	99
Heavy Sniper	X			X	X	X	X	X	X	20	10	10	3		2		126	83
MPMG	X			X	X	X	X	X	X	140	20	20			5		292	168
Infiltration	X			X											8		48	45
Fire & Move.		X		X			X		X	24					4		124	86
Squad Def.	X			X	X	X	X	X	X	31					4		83	62
ISBC		X		X	X	X	X	X	X	20	6	6	1	10			159	104
IPBC		X		X	X	X	X	X	X	43	6	14	1	8			197	123

NOTE: Verify number of targets (targetry) and building types per range. Totals loads are estimated.

RANGE ELECTRICAL LOADS

Power Circuit Voltage Drop Example: (for downrange targetry only)

Number of SATs	1		
Number of SITs	7		
Number of MITs	1		
		Thermal Blanket TB	Static
SAT (VA) ID #1	2800	1000	100
SIT (VA) ID #2	960	260	50
MIT (VA) ID #3	2000	0	50

$$\text{Current} = \frac{\text{Sum of target loads on circuit} \times \text{diversity}}{\text{Voltage}}$$

$$\% \text{ Voltage Drop} = \frac{\text{Distance} \times \text{Volt Loss Number} \times \text{Current}}{\text{Voltage}} \times 100\%$$

Volt Loss Number is taken from SPD Electrical Protection Handbook (Bussman) - Ampacity and Voltage Drop Table and multiplied by 10^{-6} .

The distance in the calculations is the distance from the current target to the previous target, power center, or power panel.

Voltage Drop Summary

ID	#1 Remain	Diversity #1	#2 Remain	Diversity #2	#3 Remain	Diversity #3	From	To	Distance-ft	Current	% V-drop
2	1	1.0	6	0.39360	1	0.75	PC	Sit 1	381	28.94	1.746
2	1	1.0	5	0.40538	1	0.75	Sit 1	Sit 2	23	22.96	0.082
2	1	1.0	4	0.42188	1	0.75	Sit 2	Sit 3	23	21.67	0.078
2	1	1.0	3	0.44661	1	0.75	Sit 3	Sit 4	23	20.38	0.073
2	1	1.0	2	0.48785	1	0.75	Sit 4	Sit 5	23	19.08	0.068
2	1	1.0	1	0.57031	1	0.75	Sit 5	Sit 6	23	17.80	0.064
2	1	1.0	0	0.81771	1	0.75	Sit 6	Sit 7	23	16.50	0.059
1	0	1.0	0	0	1	0.75	Sit 7	Sat 1	328	13.23	0.688
3	0	0	0	0	0	1	Sat 1	Mit 1	300	8.33	0.396
										Total Voltage Drop	3.254 %

The largest load is at 100% diversity, the next two largest loads are at 75% diversity. All other target loads are static.

Thermal blanket (TB) load is considered a continuous load.

Diversity Example for the SIT: (all target types' diversity may be calculated similarly)

$100\% \times (\text{SIT load w/out TB}[700\text{VA}]) + 75\% \times (\text{SIT load w/out TB}[700\text{VA}]) + 75\% \times (\text{SIT load w/out TB}[700\text{VA}]) +$
 $(\text{all remaining \# of SITs}) \times (\text{Static SIT load [50VA]}) + (\text{Total \# of SITs}) \times (\text{TB load of SIT}[260\text{VA}])$

$(\text{Total \# of SITs in circuit still}) \times (\text{SIT load w/ TB}[960\text{va}])$

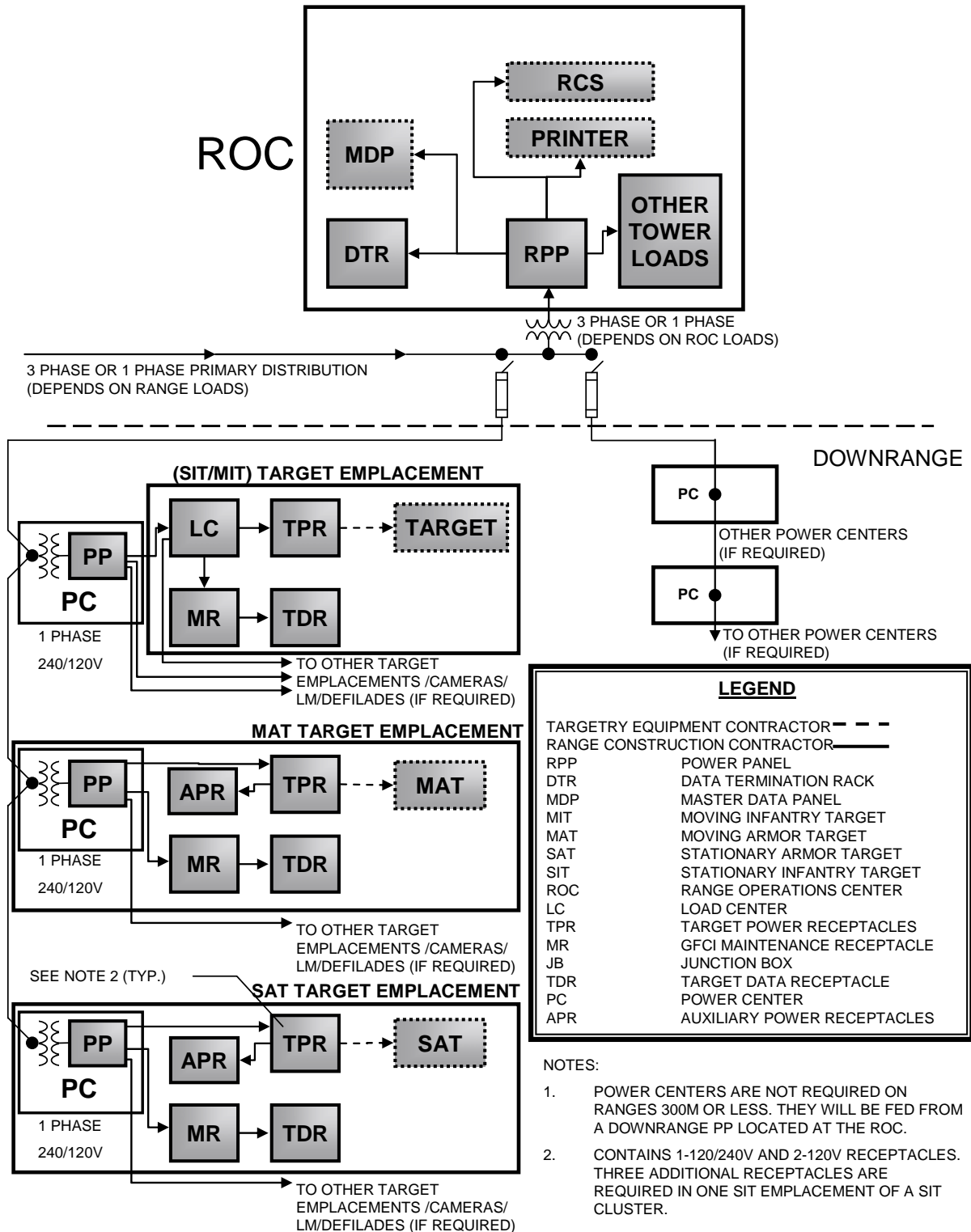
Per Example above: $(100\% \times 0 + 75\% \times 0 + 75\% \times 700 + 6 \times 50 + 7 \times 260) / (7 \times 960) = 0.39360$

General: Electrical power distribution will conform to the Architectural Engineering Institute (AEI) and Technical Manual (TM) 5-811-1. Three phase or single phase primary power will be extended to the range site depending on range load. Voltage regulation and/or metering may be required. The voltage supplied must be maintained within 5% at a frequency of 60Hz, +/-0.5; the design agency will verify the power supply for each site.

Downrange Power Distribution: All conduits and/or cables should enter and exit from the side or rear of the emplacements. This cable routing helps to minimize damage to the cables from range operations and maintenance crews performing berm repair.

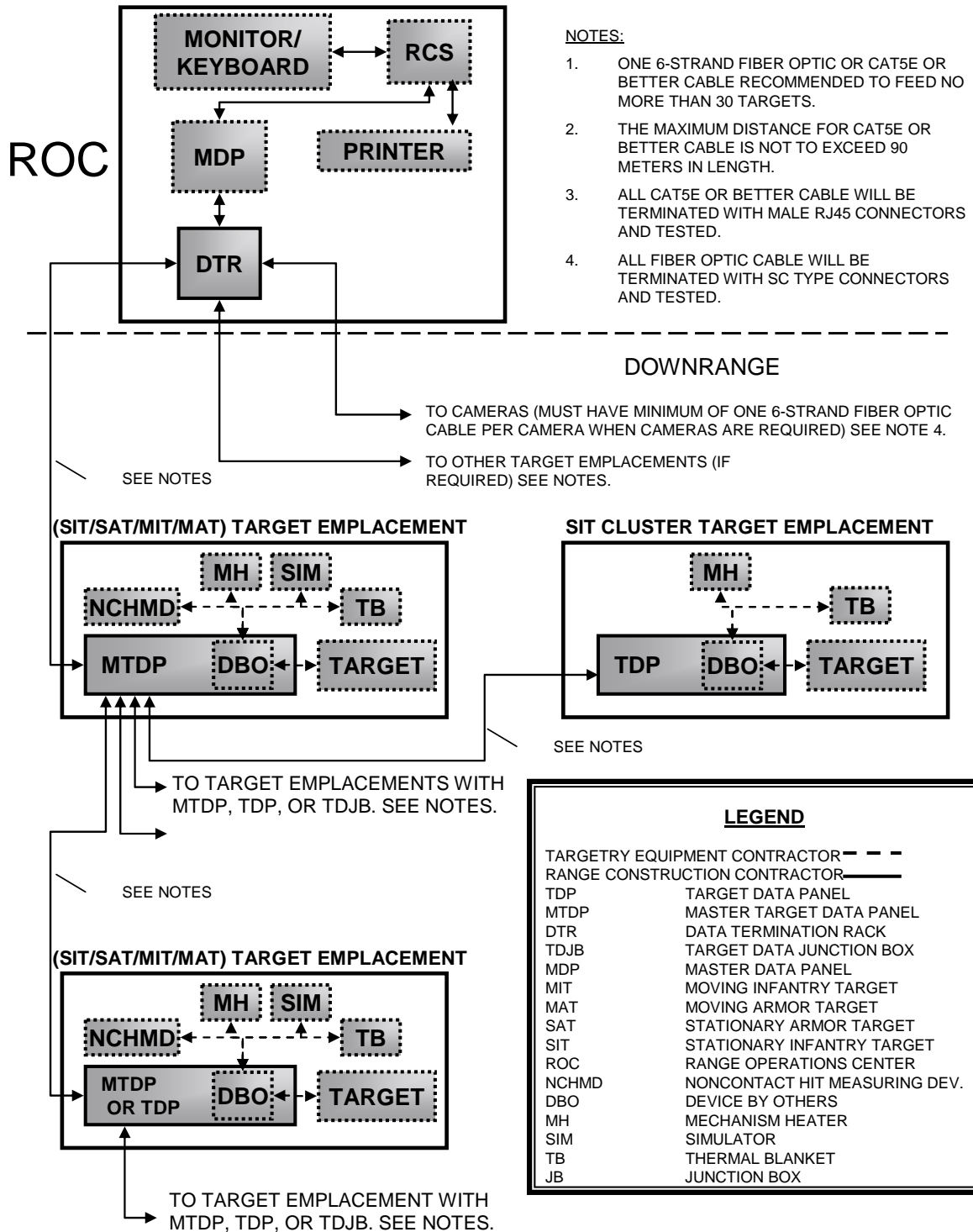
The downrange secondary power will be distributed from the ROC-Tower power panel (PP) via circuit breakers and a direct burial power cable. ROC-Tower details are discussed elsewhere in this manual. Each individual lane shall be powered with one or more circuits based on the number of targets located in each lane. Designing so that no two training lanes share a common power circuit should ensure continued range training in the event of electrical component failure. See Targetry Power Table for voltages and loads for determining the number of target emplacements per circuit. Operating voltage at the most distant emplacement should not be less than 95 percent of the supplied secondary voltage. The Load Center (LC) at the emplacement provides feed-thru capability for the secondary direct burial power cable to the next adjoining LC. The target emplacements in each lane will be “daisy-chained” or serially connected with the power cables continuing from emplacement to emplacement as required.

Downrange Data Distribution: The data distribution originates in the ROC-Tower Data Termination Rack (DTR). ROC-Tower details are discussed elsewhere in this manual. Fiber optic or copper data cabling will extend from DTR to the downrange target emplacement lanes. The design shall provide one data circuit for each individual lane of targets; no two training lanes will share a common data circuit. This will ensure continued range training in the event of an electronic component failure. Multimode fiber optic or shielded category 5E or better (copper data) cable will not exceed 30 targets per homerun. Contact the RTLP MCX at the US Army Engineering and Support Center, Huntsville, <http://www.hnd.usace.army.mil/rtlp>, if this limit needs to be exceeded. The target emplacements in each lane can be “daisy-chained” or serially connected with the copper and/or fiber optic data cables continuing from emplacement to emplacement Master Target Data Panel (MTDP) or the Target Data Panel (TDP) as long as the distance between emplacements does not exceed the 90 meter threshold. If the distance exceeds 90 meters then fiber optic cable must be used. CAT5E or better cables will not exceed 90 meters in total length between signal boosters (i.e., targets) with any application.



THIS FIGURE DOES NOT IMPLY THE ORDER IN WHICH DIFFERENT TYPES OF TARGETS ARE CONNECTED.

DOWNRANGE POWER DISTRIBUTION



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DOWNRANGE DATA DISTRIBUTION